

We claim:

1. A method of recycling bonded fibrous materials, the
5 method comprising,

providing pieces of bonded fibrous materials, the pieces
having sizes that are adapted for suspension in a liquid;

suspending the discrete pieces of bonded fibrous
materials in a liquid;

10 applying mechanical work to the liquid suspension of
discrete pieces to generate hydraulic pressure and mechanical
shear stress conditions sufficient to hydraulically fragment
the bonded fibrous materials into fibers and fiber-like
components; and

15 separating substantially individual fibers and fiber-
like components from the liquid.

2. The process of claim 1 wherein the step of providing
discrete pieces of bonded fibrous materials comprises an
20 operation to reduce the size of unitary bonded fibrous
materials into discrete pieces that are adapted for
suspension in a liquid, the operation being selected from
mechanical shredding, mechanical cutting, mechanical tearing,
mechanical grinding, water jet cutting, laser cutting,
25 garnetting and combinations thereof.

3. The process of claim 1 wherein the mechanical work
is applied to the liquid suspension utilizing a combination
of blades mounted on a rotating roll and blades mounted on a
30 fixed plate to generate areas of very high hydraulic pressure
and mechanical shear stress.

4. The process of claim 3 wherein the blades mounted on
the fixed plate are aligned at an angle in at least one
35 dimension with respect to the direction of rotation of the
rotating blades.

5. The process of claim 4 wherein the angle is between 20 degrees and 70 degrees.

6. The process of claim 1 wherein the mechanical work is applied to the suspension in multiple stages.

7. The process of claim 6 wherein mechanical work is applied to the suspension utilizing a first stage under conditions to generate hydraulic pressure and mechanical shear stress sufficient to wet the pieces of bonded fibrous materials and separate at least some portions of fibers and fiber-like components from the bonded materials and utilizing a second stage under conditions to generate hydraulic pressure and mechanical shear stress conditions sufficient to rupture the bonded fibrous materials, fibers and fiber-like components into substantially individual fibers and fiber-like components.

8. The process of claim 6 wherein the clearance between the rotating blades and the fixed blades at the closest point during the first stage is between about 20 millimeters and about 100 millimeters and between about 1 millimeter and about 20 millimeters during the second stage.

9. The process of claim 1 wherein the amount of mechanical work applied to the liquid suspension is greater than about 6 Horsepower - 24 hours per dry ton of bonded fibrous material.

10. The process of claim 1 wherein the bonded fibrous materials are selected from woven fabrics, knitted fabrics, nonwoven webs and combinations thereof.

11. The process of claim 10, wherein the nonwoven webs are webs that are thermally bonded, adhesively bonded,

mechanically entangled, solvent bonded, hydraulically entangled and combinations thereof.

12. The process of claim 1 wherein the bonded fibrous materials are composed of synthetic fibrous materials, natural fibrous materials and combinations thereof

13. The process of claim 12 wherein the synthetic fibrous material includes thermoplastic fibers and filaments.

14. The process of claim 1 wherein the substantially individual fibers and fiber-like components have a relatively uniform length distribution.

15. The process of claim 14, wherein the fiber and fiber-like material has a length distribution that spans approximately 7 millimeters.

16. Fiber and fiber-like materials produced according to the process of claim 1.

17. Recycled synthetic fibers and fiber-like materials comprising:

at least one thread element composed of synthetic material having at least one irregular distortion generated by hydraulic fracture of the thread element to separate it from a bonded fibrous material while the bonded fibrous material is suspended in a liquid.

18. The recycled synthetic fibers and fiber-like materials of claim 17, wherein the thread element has a length ranging from about 1 millimeter to about 15 millimeters.

19. The recycled synthetic fibers and fiber-like materials of claim 18, wherein the thread element has a

length ranging from about 1.5 to about 10 millimeters.

20. The recycled synthetic fibers and fiber-like materials of claim 18, wherein the thread element has a length ranging from about 2 to about 5 millimeters.

21. The recycled synthetic fibers and fiber-like materials of claim 17, wherein the irregular distortions are in the form of bends in the thread element, flattened segments of thread element, expanded segments of thread element and combinations thereof.

22. The recycled synthetic fibers and fiber-like materials of claim 17, wherein the thread elements of the recycled materials have surface areas that are greater than comparable thread elements in the bonded fibrous material prior to hydraulic fracture of the thread element to separate it from the bonded fibrous material.

23. The recycled synthetic fibers and fiber-like materials of claim 22, wherein the surface areas of the recycled thread elements are at least about 5 percent greater than comparable thread elements in the bonded fibrous material prior to hydraulic fracture of the thread element to separate it from the bonded fibrous material.

24. The recycled synthetic fibers and fiber-like materials of claim 17, wherein the synthetic material is a synthetic thermoplastic material.

25. A nonwoven fibrous web comprising the recycled synthetic fibers and fiber-like material of claim 17.

26. The nonwoven fibrous web of claim 25 wherein the web is formed utilizing a web forming process selected from wet forming, dry forming, foam forming and combinations thereof.

27. The nonwoven fibrous web of claim 25 wherein the web
further includes non-recycled natural fibrous materials, non-
recycled natural synthetic materials, recycled natural
5 fibrous materials, particulates materials and combinations
thereof.

FOOTNOTES